Global Flood and Landslide Monitoring and Forecasting using Satellite Data

Robert Adler

Huan Wu

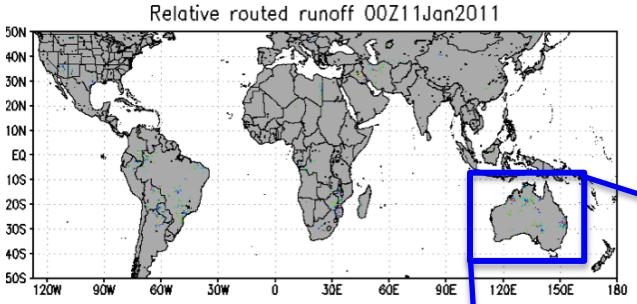
(U. of Maryland)

Fritz Policelli

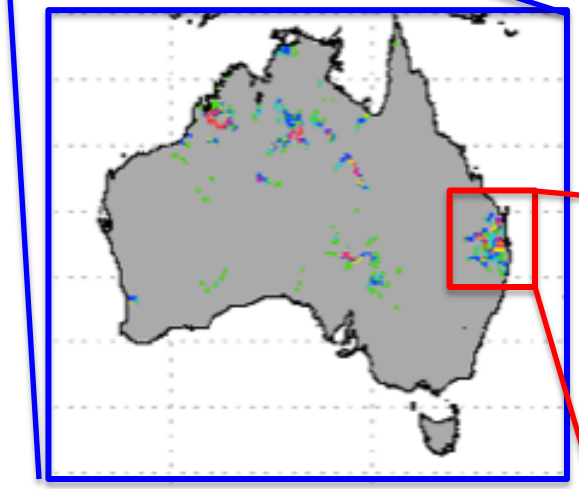
(NASA/GSFC)

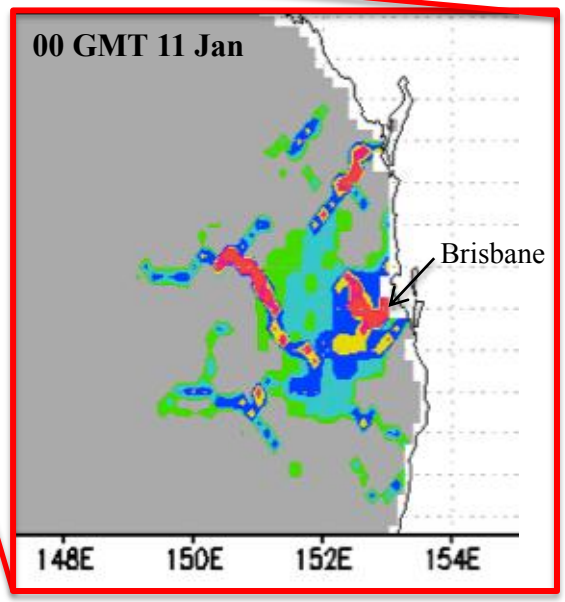
Dalia Kirschbaum

(NASA/GSFC)

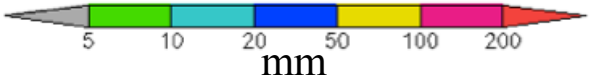


Australian Floods
11 January 2011





Relative Routed Runoff—calculated water depth above 95th percentile threshold—values above 50 clearly associated with flooding



Three Related Projects in Estimating Floods and Landslides from Space

1. Monitoring **global floods using satellite rainfall and a hydrological model**

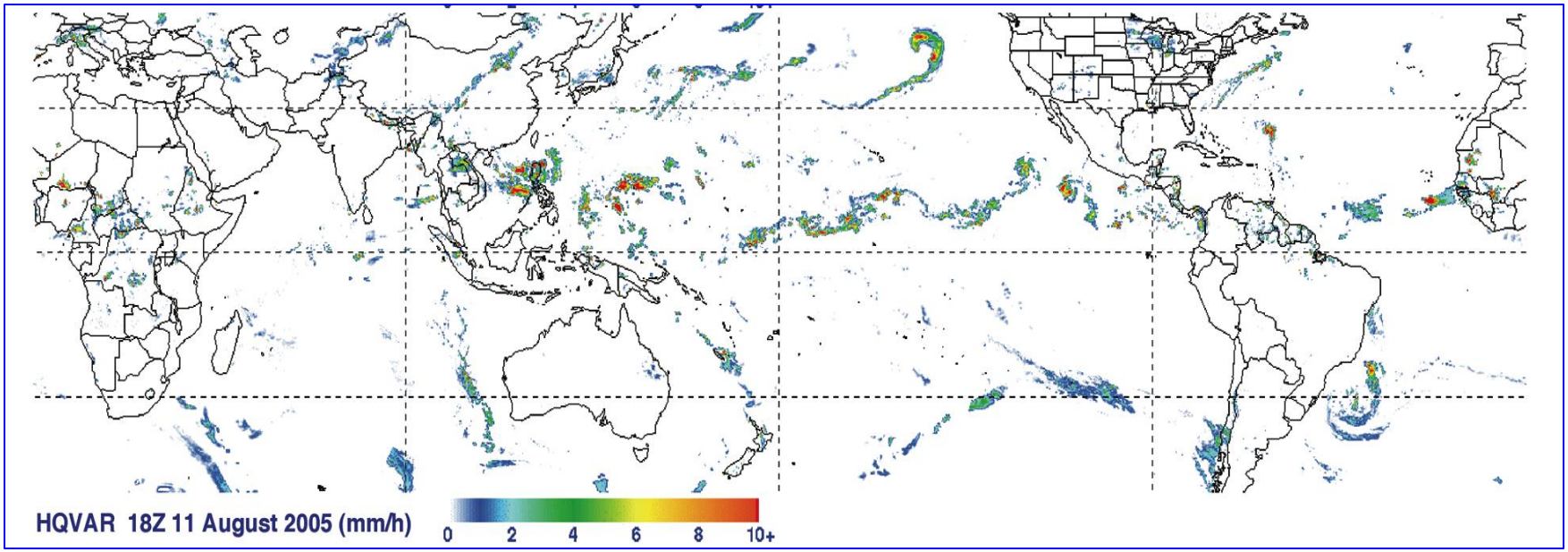
2. Monitoring **global flood extent** using satellite imagery (e.g., visible from MODIS and Synthetic Aperture Radar [SAR])

3. Estimating **landslide occurrence globally** using satellite rainfall and surface data

We now have the ability to accurately monitor heavy rain events globally

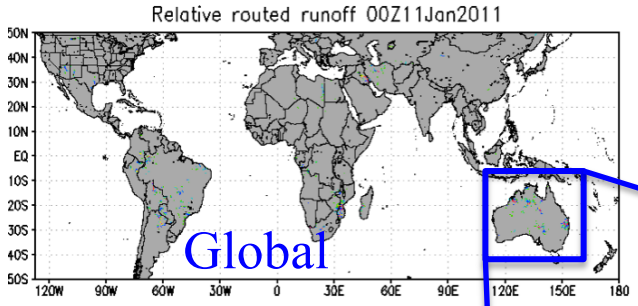
Tropical Rainfall Measuring Mission (TRMM)

TRMM Multi-Satellite Precipitation Analysis (TMPA/3B42)

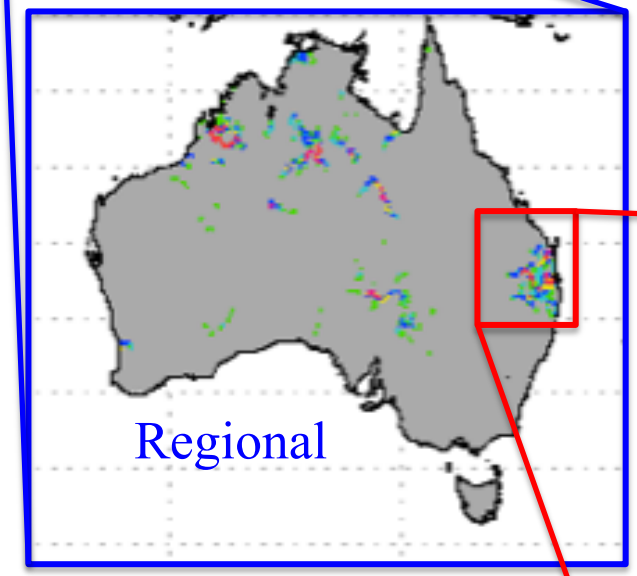


3-hr, 0.25° lat./long/ resolution-data available ~ 6 hrs after observation

Australian Floods January 2011



A global hydrological model uses satellite rainfall and other information to calculate stream flow and water depth. Thresholds based on historical runs are used to set flood thresholds locally



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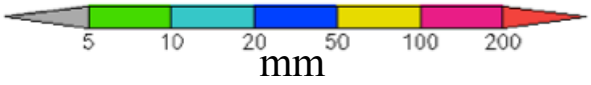
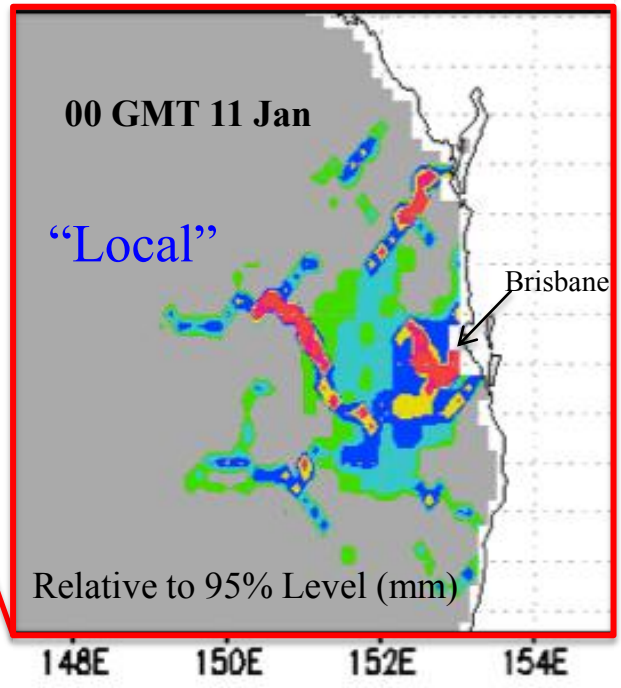
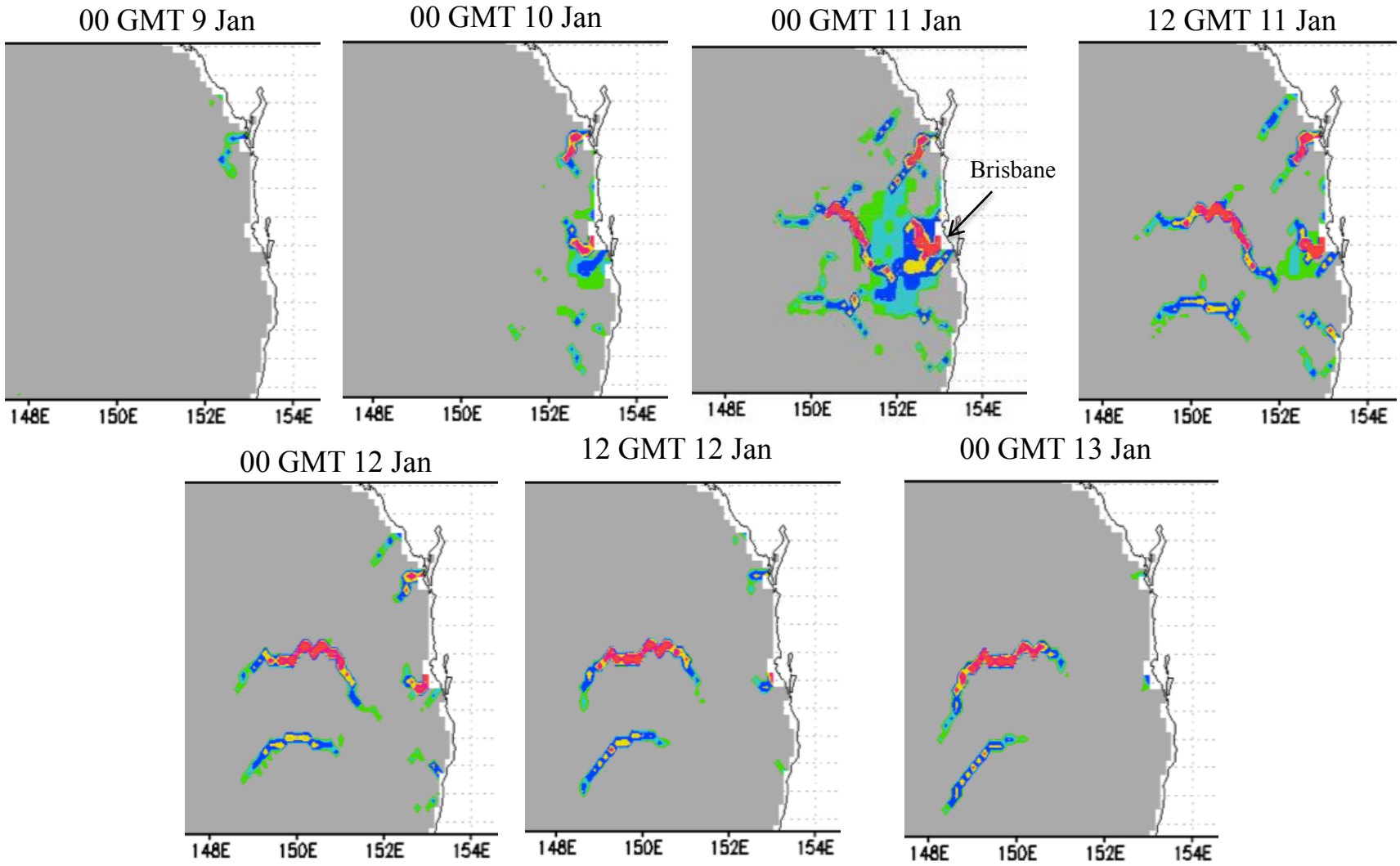




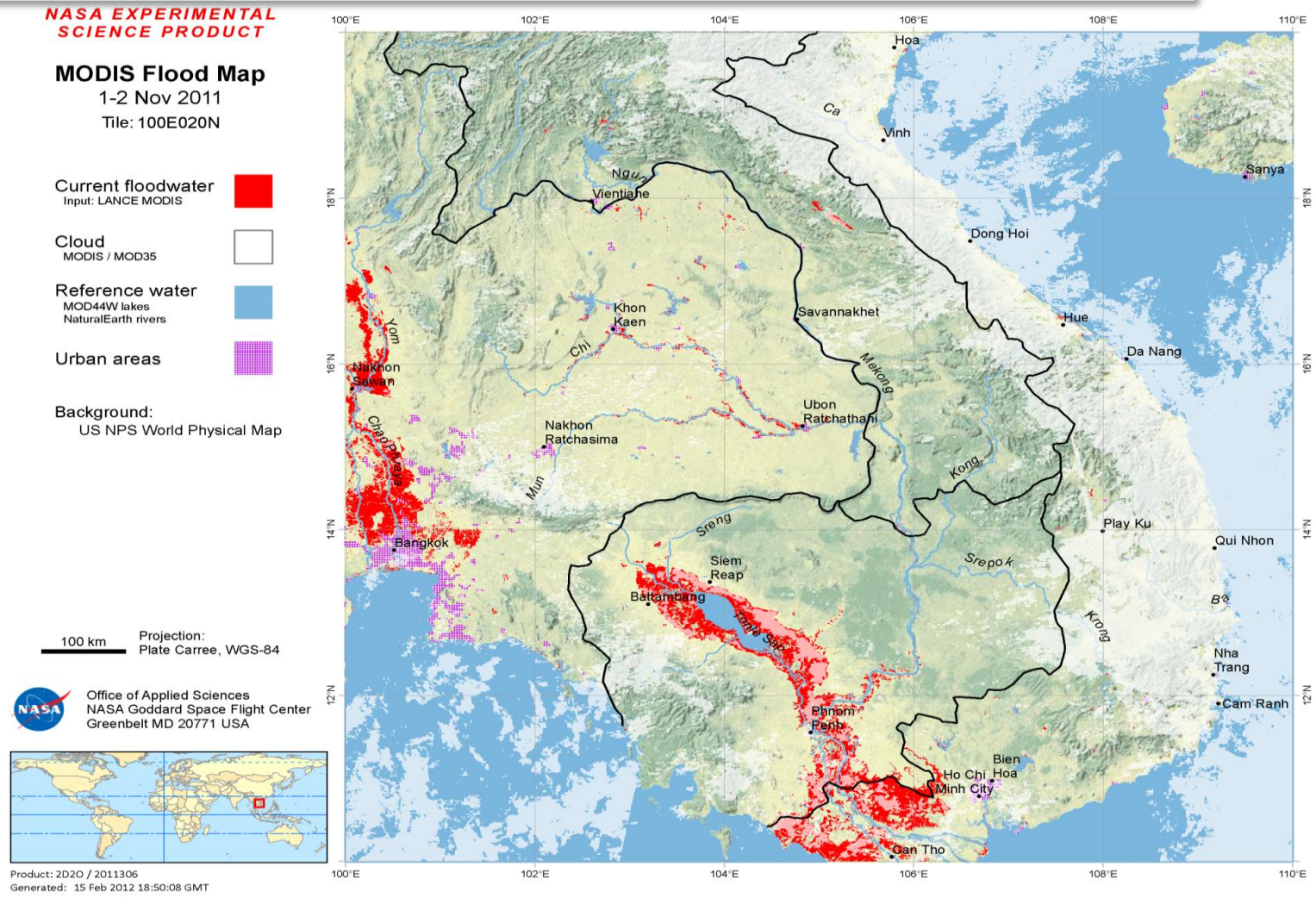
We Can Monitor Flood Evolution—Is the flood getting worse?

Australian Floods
9-13 January 2011



Automated Flood Mapping Using MODIS Data—complements hydrology calculations just shown

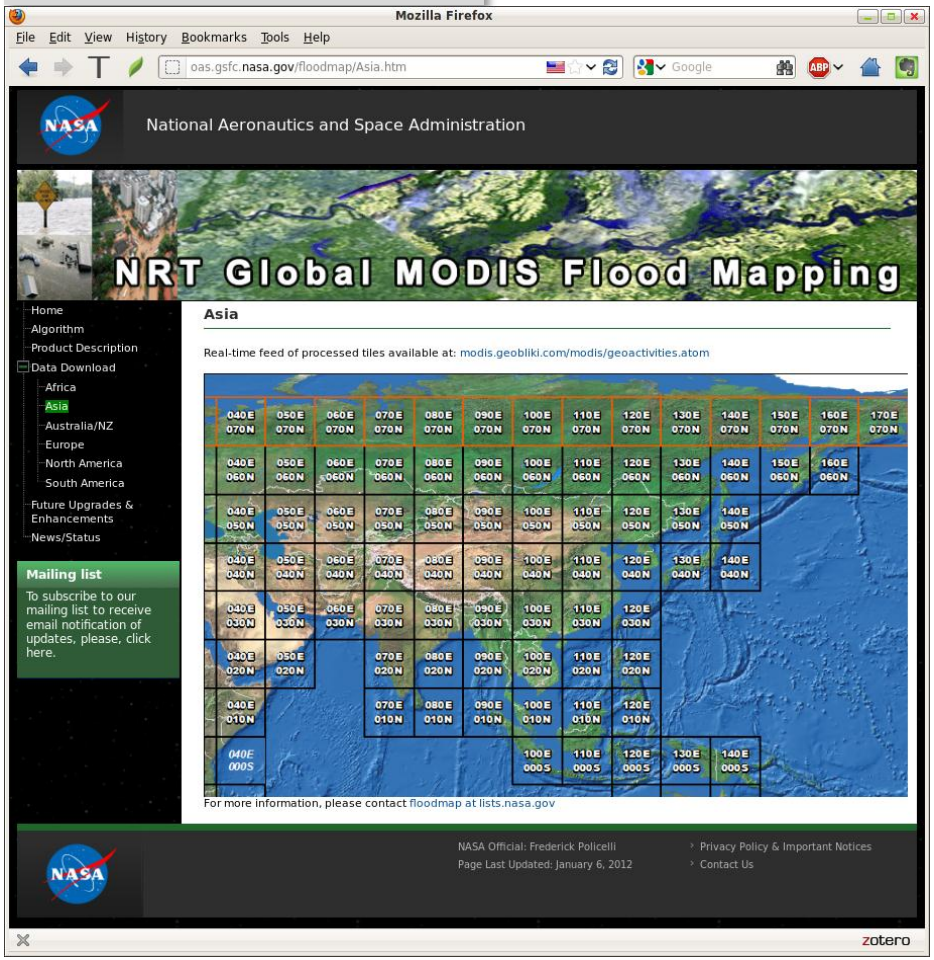
Distribution Products: MODIS Flood Map (MFM) 10° tile png graphic



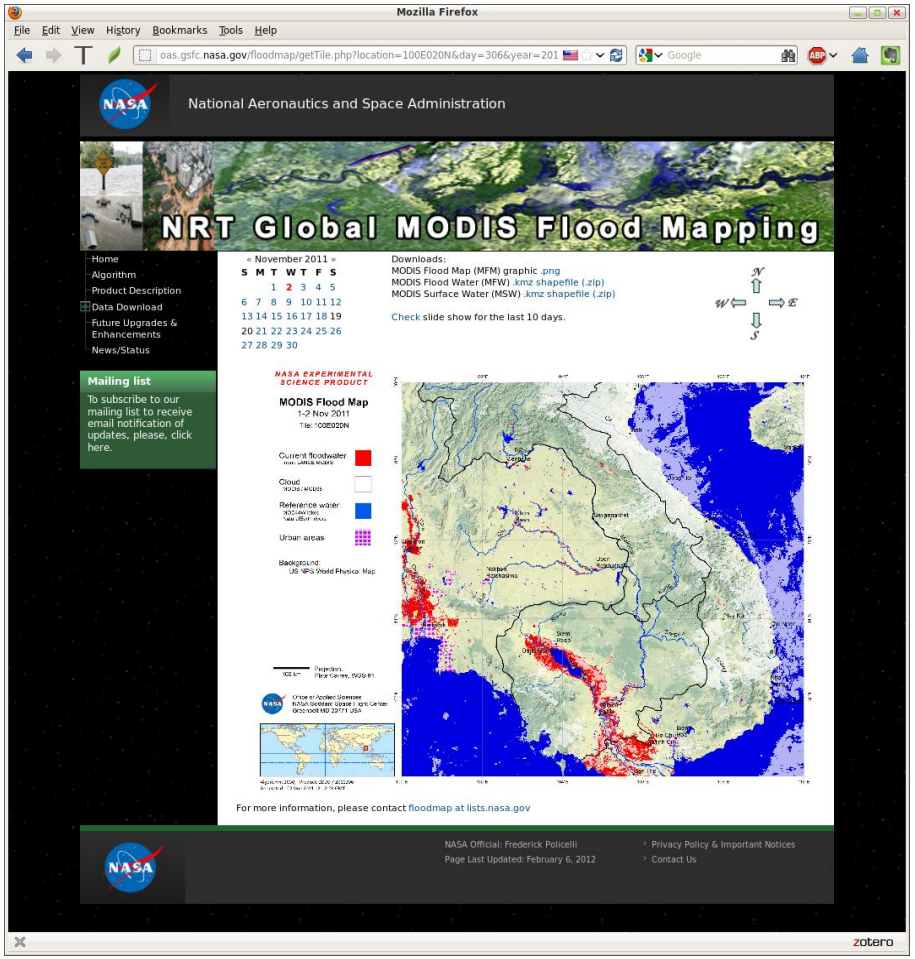
Geographic Tiles Automatically Produced and Available for Use

Distribution: OAS website

http://oas.gsfc.nasa.gov/floodmap



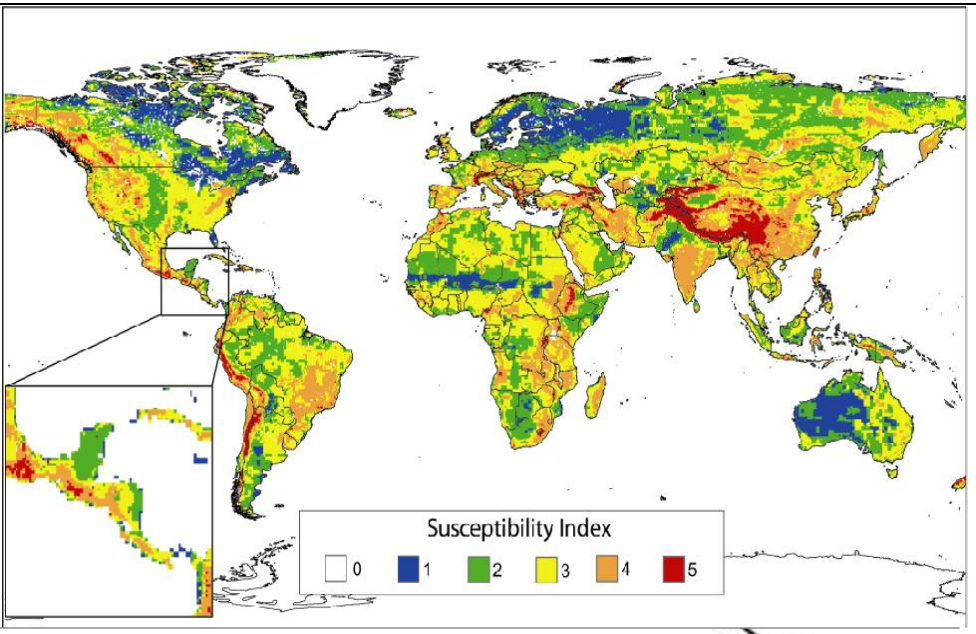
Continental tile overview

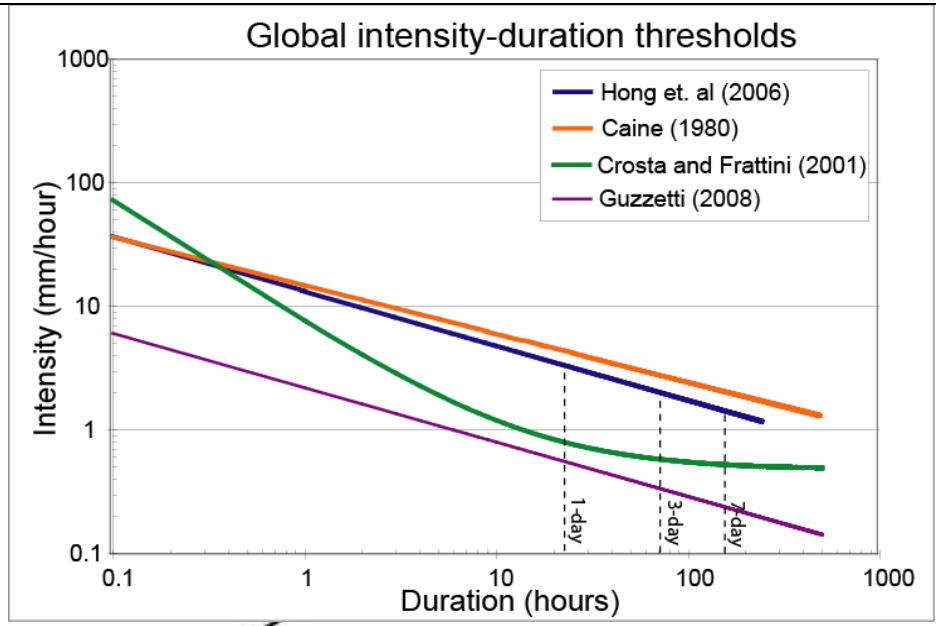


Specific tile:

- date selection
- adjacent tile navigator

Global Landslide Nowcasting





Surface Data:

- Topographic variables
- Land cover
- Soil Type and Texture
- Drainage Density

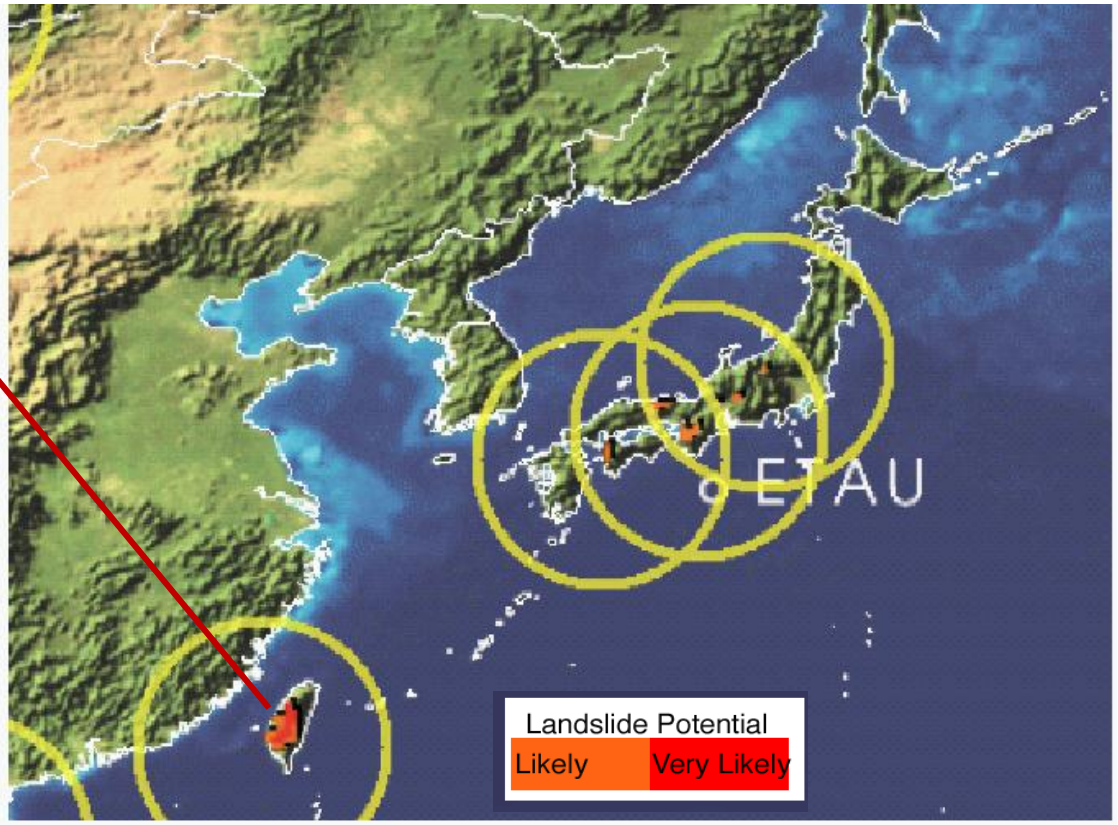
Rainfall Data:
TRMM Multi-Satellite Precipitation Analysis (TMPA)
0.25° pixel resolution, 3-hourly

Circles enclose small areas of estimated landslide activity

Example of Landslide Nowcast/Forecast

Typhoon Morakot (Etau) August 8, 2009

Numerous and **massive landslides** throughout Southern and Central Taiwan. Over 500 people killed in Shiao Lin



We can estimate areas of high potential for landslides using satellite rainfall and surface information

Summary and Future Work

- **Global flood and landslide estimation and observation has achieved initial success.** However, significant room for technical improvement, operation readiness, transfer of information and techniques to under developed countries and scientist and disaster management training

Improvements Needed

- **Improved precipitation information** via time-space integration, geo-IR, ancillary data, model input, **Global Precipitation Measurement (GPM)** mission [2014]

  Big issue is shallow orographic rainfall—passive techniques tend to underestimate significantly

- **Improved global hydrological and landslide modeling** via finer resolution, possible nested approach, regional and basin tuning, accounting for water management (dams), inclusion of snow melt processes
- **Automated flood mapping** will improve via corrections for mountain and cloud shadows and use of space radar data to "see" through clouds
- **Use of NWP** precipitation information in both global and regional context—as models improve joint use of satellite and model rainfall for flood and landslide applications will also improve